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Review Of The Literature And  
Miscellaneous Other Parameters  
Relating To Water Levels In  
The Peace Athabasca Delta  
Particularly With Respect To  
The Effect On Muskrat Numbers.

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January 1986

## Introduction:

In preparation for the January 1986 meeting of the P.A.D. Committee a review of most of the available literature (not all) to date was undertaken with an eye to identifying possible information gaps and other parameters which may warrant further consideration in future investigation by the P.A.D. Committee. The idea of this exercise is not to provide answers to some of the ongoing problems in the P.A.D. but rather to raise questions about some parameters which may not have been considered or weighted heavily enough in the past.

## Objectives:

1. Through personal interviews with local trappers and area residents attempt to reconstruct the occurrence of major cycles or events in the P.A.D. within memory.
2. Attempt to determine if a significant correlation existed between high water levels and muskrat numbers (as determined through trapping records).
3. Attempt to determine the amount of muskrat trapping around big lakes, creeks and river systems, as compared to perched basins.
4. Is there a relationship between high and low water conditions in the P.A.D. and long term weather patterns in the drainage basins of the Peace River and the Athabasca River?
5. Has the influence of ice jam flooding of both the Peace and Athabasca Rivers with respect to replenishing water levels in perched basins been weighted heavily enough as a significant factor in this process?
6. Are the weirs restoring the P.A.D. to its "natural" state? What about the free flow of water through the Quatre Fourche?
7. What effect have the weirs had in restoring water levels in the Push-up Lake, Gerry's Lake and Egg Lake areas? These were once highly productive areas for muskrat trapping.
8. Do computer models projecting expected muskrat numbers correlate with real population status?
9. Does the average market price for muskrat pelts exert a strong influence on trapping effort regardless of muskrat numbers? I.e., is trapping success during times of low prices a reasonable indicator of muskrat numbers?
10. Is the natural succession process from water to dry land being considered as a possible reason for the dryness of

the perched basins at this point in time?

Discussion:

1. Some of the main events since 1930 in the P.A.D. as determined by personal interviews (Appendix I) are as follows.
  - 1930 - spring ice jams on the Peace which resulted in flooding and high water.
  - 1934 - spring ice jam flooding from the Peace River. Good success in muskrat trapping.
  - 1945-1955 - a period of low water in the delta, dry perched basins, few muskrats and poor muskrat prices (Figure 3).
  - 1955-1967 - period of high water and very high muskrat harvest 1965-66 (144,000 W.B.N.P.).
  - 1957 - ice jam flood from Peace River.
  - 1960 - ice jam flood. First the Peace River then the Athabasca.
  - 1962 - ice jam from the Athabasca.
  - 1974 - ice jam flood from Peace River. Highest flood levels in recorded history. The Athabasca was said to have contributed to the flood as well.
2. There is a strong correlation between high water levels and high trapping success, especially if perched basins are flooded by ice jams (Figure 1 and 2).
3. Generally trappers will trap out muskrats in perched basin lakes and shallow water areas first and then trap muskrats along the large lakes and rivers and streams last. There are always a certain amount of muskrats along the big lakes and in the rivers and streams. These are called "bank rats" and are thought to be the stable "seed" source for increasing numbers when conditions are suitable in the perched basins (J. Courtoreille and R. McKay pers. comm. 1986). Poll (1980) divides these into the Active Delta (open drainage basins) which represented 43.2% of the total area and contained 34.8% of the muskrat houses as compared to the Semi-Active Delta (perched basins) which represented 27.2% of the total area but contained 64.2% of the muskrat houses.
4. There is not sufficient climatological data at hand to adequately address this question. There are climatological cycles which have been documented in association with agriculture. The "dirty thirties" for example, and about

an 8 year low moisture cycle currently taking place in Southern Alberta. Figure 1 would suggest that runoff and perhaps precipitation from 1949 to 1959 were below average while 1960 to 1967 were above average. The tree ring dendrochronology work as shown on page 34 of the P.A.D. Technical Report (1973) would suggest that long term variations (10 to 20 years) in climatological conditions did and continue to take place. It is possible that part of the reason the P.A.D. is so dry at present is because of a relatively long dry cycle. The years 1980 and 1981 were record years for acreage of trees burned in W.B.N.P. which may be another indicator of the dryness. During the early 50's all of the perched basins in the P.A.D. were dry and beginning to be overgrown by willows (R. Fraser pers. comm. 1986) so although people generally tend to remember the times of plentiful muskrats and good trapping associated with high water, there were some pretty dry periods under the "natural" condition.

The perched basins on the Chipewyan Reserve are influenced more by the effects of the Athabasca River which for the present is in its "natural" condition. There too, the perched basins have been in a relatively dry condition for some time except for some recent water level manipulation in 3 basins.

5. The significance of ice jam flooding, mostly from the Peace River as it effects the recharging of the perched basins is probably the single most under rated factor in the hydrological complex of the delta. The annual maximum water levels in Lake Athabasca as reflected by high water events in the river systems usually takes place in July (Table 1, Figure 1). Only in 1935 and 1936 has the gradual raising of water levels as a result of run-off been responsible for 100% flooding of the perched basins. Since 1930, however, there have been at least 9 major instances of ice jam flooding early in the year (end of April, early May) which have resulted in recharging of perched basins to a greater or lesser degree. There have probably been some smaller ice jam floods as well affecting those basins closer to the Peace River. Horace Wylie (per. comm. 1986) commented that spring ice jam flooding from the Peace River to a greater or lesser degree was a frequent occurrence in the Egg Lake area where he has spent most of his life.

Generally speaking perched basins south of a line running west from Fort Chipewyan would be affected more by ice jam flooding from the Athabasca while perched basins north of this line would be affected more by ice jam flooding on the Peace River.

6. According to the P.A.D. Committee Report of June 1985 water levels in Lake Athabasca have an average been restored to levels preceeding construction of the Bennett

TABLE I

MAXIMUM ANNUAL LAKE ATHABASCA  
WATER LEVELS AT FORT CHIPEWYAN  
AND CUMULATIVE PERCENTAGE OF  
PERCHED BASINS FILLED.

<u>YEAR</u>	<u>LEVEL</u>	<u>MONTH</u>	<u>% of Perched Basins Filled</u>
1930	686.17	Nov. Only Nov. & Dec.	4.6
1931	688.07	June No data after June	22.9
1934	688.40	Aug. No data to Aug.	35.3
1935	693.35	July	100.
1936	692.85	July	100.
1937	689.35	June	64.7
1938	687.81	June	22.9
1939	687.05	July	7.2
1940	687.8	July	22.9
1941	688.5	July	35.3
1942	689.15	June/July	64.7
1943	688.4	July	35.3
1944	686.87	June	7.2
1945	684.92	June	0.
1946	686.09	July	4.6
1947	689.12	June	64.7
1948	690.92	June	88.9
1949	687.17	Sept.	13.7
1950	687.25	July	13.7
1951	688.55	June/July	35.3
1952	687.2	July	13.7
1953	686.25	July	4.6
1954	686.15	May Only month recorded	1.3
1955	689.07	July	53.6
1956	687.25	July	13.7
1957	686.91	Aug.	7.2
1958	688.8	June	53.6
1959	687.72	July	22.9
1960	691.21	July	91.5
1961	688.8	June	53.6
1962	691.19	Aug.	91.5
1963	690.01	July	77.8
1964	691.4	Aug.	91.5
1965	691.67	July	94.8
1966	689.3	July	64.7
1967	690.97	July	88.9
1968	685.28	June	0.
1969	686.16	June	4.6
1970	685.68	June	1.3
1971	689.23	July	13.7
1972	688.95	July	53.6
1973	687.87	July	22.9
1974	689.82	July	77.8
1975	687.28	July	13.7
1976	689.36	Oct.	64.7
1977	688.7	July	53.6
1978	687.99	Sept.	22.9

<u>YEAR</u>	<u>LEVEL</u>	<u>MONTH</u>	<u>% of Perched Basins Filled</u>
1979	689.63	July	77.8
1980	686.02	July	1.3
1981	686.14	June	4.6
1982	686.9	Aug.	7.2
1983	686.6	Aug.	7.2
1984	687.9	Oct. 17	22.9
1985			

Dam. In Lake Mamawi and Lake Claire the average maximum water levels have been increased. The net result is that the amplitude of average water level fluctuations in these two lakes has been reduced as well as the effect this might have on associated perched basins. The major long term concerns under this condition are as follows:

- a) perched basins associated with Lake Mamawi and Lake Claire which would "normally" get recharged during high water peaks in the amplitude will now no longer be recharged.
- b) low water levels which occurred under the "natural" condition are not occurring. These low water periods are necessary to the reseeding of emergent vegetation which in turn are very important to muskrats.

Within the P.A.D. complex the amplitude of water levels may very well be as important as the presence of water itself.

Prior to Bennett Dam construction the Peace River acted as both a "hydraulic plug" to help maintain high water levels in the P.A.D. and on many occasions actively filled the P.A.D. when it was at a higher level. At present, although the weirs on the Riviere de Roches and the Coupé simulate the effects of the hydraulic plug, the Quatre Fourches River is an open line from the P.A.D. to the Peace River. Any high water events from the Athabasca side which might tend to flood the P.A.D. probably quickly drain off down the Quatre Fourches to the Peace River. Is another control structure required on the Quatre Fourches where it empties into the Peace River to more closely duplicate what were the natural effects of the Peace River itself? This possibility would present a number of difficulties as far as navigation and fish movement is concerned, but it is quite likely that efforts to duplicate the once natural effect of the Peace River are only 2/3 complete in this area.

7. Jerry's Lake, Push-up Lake and Egg Lake were once highly productive areas for muskrats. At one time Jerry's Lake alone supported 15 trappers (R. Fraser pers. comm. 1986). It is possible that because of the location of the weirs on the Coupé and the Riviere de Roches that hydrologically these lakes are isolated from the influence of the weirs and will not be recharged unless it is by ice jam flooding from the Peace River as it occurred in 1974.
8. Figure 4 illustrates the Townsend computer model used to simulate fall muskrat numbers for the period from 1970 to

the present. The empirical data used as a basis for the model was collected in 1971. Although at present there is no recent field data on muskrat numbers to compare to the model, field observations and information from trappers suggest that the model estimates do not approximate the numbers of muskrats actually in the P.A.D.

9. At present there is not sufficient information available on both the muskrat harvest and average pelt prices to determine if there is a relationship here. There was low water, few muskrats, poor prices and poor harvest of muskrats in the early 50's (R. Fraser per. comm. 1986). In the mid 70's on the other hand there was plenty of water, lots of muskrats, a fairly good price, and a high muskrat harvest. One can only speculate that if muskrats were very plentiful and the price was very low that it might not be worthwhile with the high cost of equipment and fuel to go out after them. Willie Courtoreille (per. comm. 1985) commented that the price of muskrat pelts really didn't matter, that many people particularly the older trappers would still go out after them as they have all their lives.
  
10. Many of the larger deltas of the world empty into the ocean and are free to build out and deposit sediment as far as they like. The P.A.D. is a large inland delta and as such has only a limited area to expand. It has likely been building for the past 10,000 years since the last ice age. Both the Athabasca and Peace Rivers carry a high sediment load which drops out when the velocity is reduced such as when the river empties into a lake or floods out over its banks. The deposition of sediment and the natural soil building process by vegetation act to turn areas which once held water into dry land. This sounds pretty basic, but it may very well be a significant process which has been overlooked as a factor in the drying out of the P.A.D. Independent remarks were made by both Roddy Fraser and Sammy Tuccaro (pers. comm. 1986) that it seemed to them that there used to be more and deeper water in the perched basins on their traplines. It seemed to them that even though the basins were recharged recently (1974) that the water did not stay as long as it used to. In addition, it is estimated that perched basin water levels decline by 1.52 feet annually if not replenished by spring run-off or flooding. In a series of dry years most of the shallow perched basins would dry up.

Removing the "natural" influence of the Peace River from the hydrodynamics of the P.A.D. may have accelerated the succession process to dry land many times.

Conclusions:

- A. The natural influence of the Peace River in the hydrodynamics of the P.A.D. is gone for the foreseeable future.
- B. Ice jam flooding with respect to the replenishing of perched basins may be the single most important factor in flooding 100% of the basins.
- C. Within the P.A.D. it seems that filled perched basins plus emergent vegetation equals muskrats. The Chipewyan Reserve has initiated water manipulation projects in 3 perched basins, South Egg Lake, Johnny's Lake, and Freezie Lake. The results here will be compared with 3 control basins. Although it is too early in the project for hard scientific data, Freezie Lake had 20 muskrat houses on it and was then flooded to a level of 5 feet in 1984-85. The number of muskrat houses in one year has increased to 200 (J. Rigney pers. comm. 1986).
- D. The whole P.A.D. may be under the influence of a long-term dry climatic cycle which may make things appear worse than they are. The Birch River has flooded the perched basins along its length however, in both 1984 and 1985.
- E. The weirs have not restored the amplitude of water levels in the P.A.D. as it existed in the "natural" condition. The importance of this amplitude may be as significant to the delta as the presence of water itself.
- F. The Quatre Fourches River is an open drain in the system and may be preventing perched basin flooding by allowing excess water to run off to the Peace River.
- G. The succession process may be responsible to a large degree in the drying out of the delta and the filling in of the perched basins. This process may have been accelerated many times by the absence of the influence of the Peace River in its "natural" condition.

## Appendix I

The following is a historical reconstruction of some significant high water events, spring floods, periods of low water, and good trapping success for muskrats, based on personal interviews with local residents.

Roddy Fraser - park trapper (R.T.A.) and park employee from 1947 to 1974.

- 1926 - The steam boat "Keewatin" made trips to the Chipewyan settlement at Birch River on the West side of Lake Claire.
- 1930 - Roddy worked for free trader Tom Woodman on the Coupé River near Egg Lake and in early May during a spring flood from the Peace River he had to put all his dry goods into the attic of his cabin and climb out through the roof. He put all of his dogs in a skiff and was able to boat across an overland portage near Horace Wylie's cabin into the Egg Lake area. The only dry land around was the islands of rock of Cambrian shield, the rest was all water.
- 1934 - A very high water spring flood in early May. Water flowed from the Peace River overland into the delta and the Jerry's Lake area. Roddy trapped and shot about 800 muskrats in a week at a price of \$.84 each. There were about 15 trappers working this area and each of them probably caught in excess of 1,000 muskrats.

Apparently in February of 1934 there was a long period of warm weather which caused the ice to break up and move in the Peace Point area. The ice pushed up over the banks and moved Simpson's house which was on the South side of the Peace River at that time. The ice jam at Peace Point was backed up about 12 miles upstream.

The winter of 1933-34 was one of deep snow and thick ice.

- 1955 - For about a 10 year period prior to 1955 there was no water in the basin lakes, very few muskrats and poor prices. Roddy remembers making a trip in the Jerry's Lake area with Frank McCall and that the bottom of the lake was so overgrown with willows that he had to stand up on the back of his toboggan to see over them and orient himself.
- 1957 - Roddy, Sonny Flett and their families were out spring trapping in the Prairie River area when they were caught in spring floods coming in overland from the Peace River. They were in their boats for 19 hours fighting against the water current and ice trying to

find dry land. They ended up tying their boats in the trees at Poplar Island southwest of Dog Camp and making nests in the trees out of sticks.

- 1975 - In spring trapping for muskrats at Crooked Bend north of Dog Camp Roddy's son Fred caught over 1,000 muskrats in a week.

Roddy commented that years ago the basins in the Push-up, Jerry's and Egg Lake area seemed to be deeper and had a better capability for holding water for longer periods of time before drying up. Also that prior to Bennett Dam construction early spring floods in this area were frequent occurrences during the break up period. The water always came in from the Peace River side.

Charlie Flett - long time park resident born on Sweetgrass Island at the Northwest corner of Lake Claire.

- 1930 - During spring muskrat trapping in the Jabbers Creek area near Jackfish River Charlie was caught in an overland flood from the Peace River. He ended up having to untie his dogs from the toboggan to keep them from drowning. At times he had to walk in water up to his neck before making it to high ground at his parents camp. He also recalls that at Little Rapids on the Rochers River that there was ice cakes pushed on top of the hills there.

- 1957 - An early spring flood in late April or early May came in overland from first the Peace River and then there was flooding from the Athabasca side.

- 1960 - A spring flood which first came in from the Peace River and then the Athabasca.

Charlie spoke of a long period of low water that ended abruptly in the fall of 1955 to be followed by about 10 years of high water levels. Apparently the water was so low that in 1955 the military landed a D.C. 3 on the mud flats in front of the Athabasca Cafe. Following this event the water came up quite quickly and hasn't been that low since.

Sammy Tuccaro - long time resident and Park trapper.

- 1957 - While trapping in the Baril Lake, Baril River area in the spring (late April, early May) he was caught in a flood from the Peace River. The water came up rapidly and finally he had to build a platform high in the trees to sit on. At one time he heard a crashing through the trees and observed a bundle of finished lumber from the Swanson's Mill at Camp 3 come sailing

by through the trees. Camp 3 was located at the mouth of the Baril River on the south side of Moose Island.

1968-69 - Sammy recalls that at approximately that time water flowed into Baril Lake from the Peace River.

1974 - Extensive overland flooding from the Peace River in early May as a result of an ice jam at Rocky Point. This year the water levels in the Delta complex were the highest in memory. You could travel by boat from Ft. Chipewyan to Carlson's landing without hitting dry land.

Sammy also commented on the perched basins in the delta area. Like Roddy Fraser he felt that in earlier years the basins seemed to hold more, and deeper water for longer periods of time. This is perhaps because the actual depressions were deeper years ago and that they were recharged with ice-jam flooding more frequently than in the last 10 years.

Horace Wylie - long time area resident and park trapper. Horace was raised in the Egg Lake area and still has a cabin there.

Horace supported the recollection of high water events by Roddy Fraser in about 1934. He also reported that spring overland flooding from the Peace River as a result of ice jams was the rule rather than the exception in the Egg Lake, Jerry's Lake area. In some years the flooding was slight, but in other years such as 1934 it inundated the area floating the ice up out of the basins, muskrat houses, grass, and all, right out the south end of the basins toward Lake Athabasca. With the exception of 1974 he has noted these areas drying up since construction of the Bennett Dam.

Len Campbell - long time area resident and Park trapper.

Early 1960's, about 1962, he and another trapper got stranded for 3 days in a canoe at Mud Portage Creek. The flood came in overland from the Embarras River.

Matthew Fraser - long time area resident and Park trapper.

1962 - Ice jam flood in early May which came in from the Peace River.